TOSHIBA Bipolar Linear Integrated Circuit Silicon Monolithic

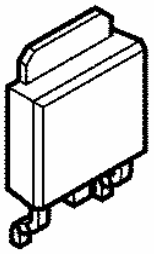
TA78M05F,TA78M06F,TA78M08F,TA78M09F,TA78M10F TA78M12F,TA78M15F,TA78M18F,TA78M20F,TA78M24F

Output Current of 0.5 A, Three-Terminal Positive Voltage Regulators

5 V, 6 V, 8 V, 9 V, 10 V, 12 V, 15 V, 18 V, 20 V, 24 V

Features

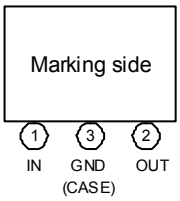
- Suitable for CMOS, TTL and the power supply of the other digital ICs
- Internal overheating protection.
- Internal overcurrent protection.
- Maximum output current of 0.5 A.
- Packaged in New PW-Mold (Surface-mount type).



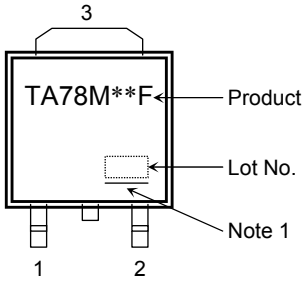
HSOP3-P-2.30D

Weight
HSOP3-P-2.30D: 0.36 g (typ.)

Pin Assignment



Marking



Note 1: A line under a Lot No. identifies the indication of product Labels.
Not underlined: [[Pb]]/INCLUDES > MCV
Underlined: [[G]]/RoHS COMPATIBLE or [[G]]/RoHS [[Pb]]

Please contact your TOSHIBA sales representative for details as to environmental matters such as the RoHS compatibility of Product. The RoHS is the Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

Note 2: The "**" part of each product number varies according to the output voltage of the product.

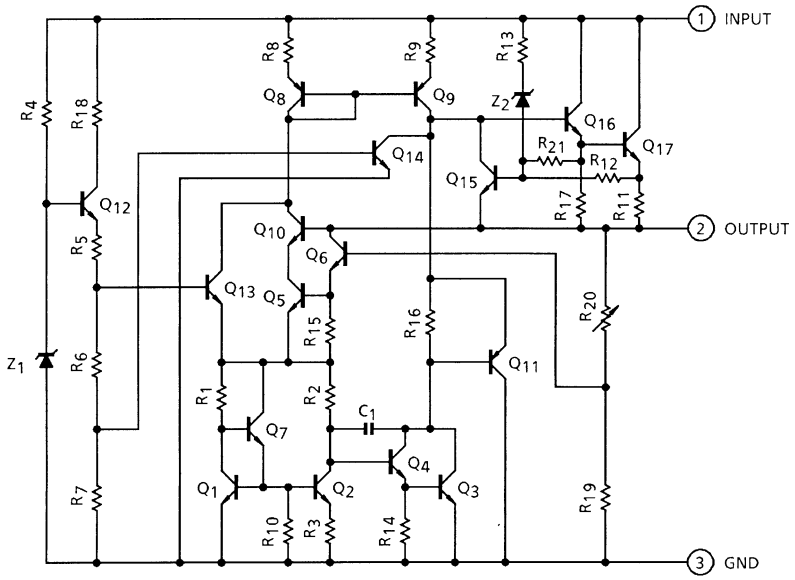
Ordering Method

Product Name	Package (Lead Type)	Packing Form
TA78M**F (TE16L1, NQ	New PW-Mold: Surface-mount	Tape (2000 pcs./reel)

Note: The "**" in each pro-forma product name is replaced with the output voltage of each product.

The product(s) in this document ("Product") contain functions intended to protect the Product from temporary small overloads such as minor short-term overcurrent or overheating. The protective functions do not necessarily protect Product under all circumstances. When incorporating Product into your system, please design the system (1) to avoid such overloads upon the Product, and (2) to shut down or otherwise relieve the Product of such overload conditions immediately upon occurrence. For details, please refer to the notes appearing below in this document and other documents referenced in this document.

Equivalent Circuit



Absolute Maximum Ratings (Ta = 25°C)

Characteristics		Symbol	Rating	Unit
Input voltage	TA78M05F	V_{IN}	35	V
	TA78M06F			
	TA78M08F			
	TA78M09F			
	TA78M10F			
	TA78M12F			
	TA78M15F			
	TA78M18F		40	
	TA78M20F			
	TA78M24F			
Output current		I_{OUT}	0.5	A
Power dissipation	(Ta = 25°C)	P_D	1	W
	(Tc = 25°C)		10	
Operating junction temperature		Tj_{opr}	−30 to 150	°C
Storage temperature		T_{stg}	−55 to 150	°C
Junction temperature		T_j	150	°C
Thermal resistance		$R_{th\ (j\text{-}c)}$	12.5	°C/W
		$R_{th\ (j\text{-}a)}$	125	

Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings and the operating ranges.
Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook (“Handling Precautions”/“Derating Concept and Methods”) and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

TA78M05F
Electrical Characteristics
(Unless otherwise specified, V_{IN} = 10 V, I_{OUT} = 350 mA, 0°C ≤ T_j ≤ 125°C, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF)

Characteristics		Symbol	Test Circuit	Test Condition		Min	Typ.	Max	Unit
Output voltage		V_{OUT}	1	T_j = 25°C		4.8	5.0	5.2	V
Line regulation		Reg·line	1	T_j = 25°C	7 V ≤ V_{IN} ≤ 25 V, I_{OUT} = 200 mA	—	4	100	mV
					8 V ≤ V_{IN} ≤ 25 V, I_{OUT} = 200 mA	—	2	50	
Load regulation		Reg·load	1	T_j = 25°C	5 mA ≤ I_{OUT} ≤ 500 mA	—	25	100	mV
					5 mA ≤ I_{OUT} ≤ 200 mA	—	10	50	
Output voltage		V_{OUT}	1	T_j = 25°C	7 V ≤ V_{IN} ≤ 20 V, 5 mA ≤ I_{OUT} ≤ 350 mA	4.75	—	5.25	V
Quiescent current		I_B	1	T_j = 25°C		—	4.5	8.0	mA
Quiescent current change	Line	ΔI_{BI}	1	T_j = 25°C	8.5 V ≤ V_{IN} ≤ 25.5 V, I_{OUT} = 200 mA	—	—	0.8	mA
	Load	ΔI_{BO}	1		5 mA ≤ I_{OUT} ≤ 350 mA	—	—	0.5	
Output noise voltage		V_{NO}	2	Tj = 25°C, 10 Hz ≤ f ≤ 100 kHz		—	50	200	μV_{rms}
Ripple rejection		R.R.	3	f = 120 Hz, I_{OUT} = 100 mA, 8 V ≤ V_{IN} ≤ 18 V, T_j = 25°C		60	67	—	dB
Short circuit current limit		I_{SC}	1	T_j = 25°C		—	960	—	mA
Dropout voltage		V_D	1	T_j = 25°C		—	1.7	—	V
Average temperature coefficient of output voltage		T_{CVO}	1	I_{OUT} = 5 mA		—	−0.6	—	mV/°C

TA78M06F
Electrical Characteristics
(Unless otherwise specified, V_{IN} = 11 V, I_{OUT} = 350 mA, 0°C ≤ T_j ≤ 125°C, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF)

Characteristics		Symbol	Test Circuit	Test Condition		Min	Typ.	Max	Unit
Output voltage		V_{OUT}	1	T_j = 25°C		5.75	6.0	6.25	V
Line regulation		Reg·line	1	T_j = 25°C	8 V ≤ V_{IN} ≤ 25 V, I_{OUT} = 200 mA	—	4	100	mV
					9 V ≤ V_{IN} ≤ 25 V, I_{OUT} = 200 mA	—	2	50	
Load regulation		Reg·load	1	T_j = 25°C	5 mA ≤ I_{OUT} ≤ 500 mA	—	25	120	mV
					5 mA ≤ I_{OUT} ≤ 200 mA	—	10	60	
Output voltage		V_{OUT}	1	T_j = 25°C	8 V ≤ V_{IN} ≤ 21 V, 5 mA ≤ I_{OUT} ≤ 350 mA	5.7	—	6.3	V
Quiescent current		I_B	1	T_j = 25°C		—	4.5	8.0	mA
Quiescent current change	Line	ΔI_{BI}	1	T_j = 25°C	9.5 V ≤ V_{IN} ≤ 25.5 V, I_{OUT} = 200 mA	—	—	0.8	mA
	Load	ΔI_{BO}	1		5 mA ≤ I_{OUT} ≤ 350 mA	—	—	0.5	
Output noise voltage		V_{NO}	2	Tj = 25°C, 10 Hz ≤ f ≤ 100 kHz		—	55	220	μV_{rms}
Ripple rejection		R.R.	3	f = 120 Hz, I_{OUT} = 100 mA, 9 V ≤ V_{IN} ≤ 19 V, T_j = 25°C		58	65	—	dB
Short circuit current limit		I_{SC}	1	T_j = 25°C		—	960	—	mA
Dropout voltage		V_D	1	T_j = 25°C		—	1.7	—	V
Average temperature coefficient of output voltage		T_{CVO}	1	I_{OUT} = 5 mA		—	−0.7	—	mV/°C

TA78M08F
Electrical Characteristics
(Unless otherwise specified, V_{IN} = 14 V, I_{OUT} = 350 mA, 0°C ≤ T_j ≤ 125°C, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF)

Characteristics		Symbol	Test Circuit	Test Condition		Min	Typ.	Max	Unit
Output voltage		V_{OUT}	1	T_j = 25°C		7.7	8.0	8.3	V
Line regulation		Reg·line	1	T_j = 25°C	10.5 V ≤ V_{IN} ≤ 25 V, I_{OUT} = 200 mA	—	5	100	mV
					11 V ≤ V_{IN} ≤ 25 V, I_{OUT} = 200 mA	—	3	50	
Load regulation		Reg·load	1	T_j = 25°C	5 mA ≤ I_{OUT} ≤ 500 mA	—	26	160	mV
					5 mA ≤ I_{OUT} ≤ 200 mA	—	10	80	
Output voltage		V_{OUT}	1	T_j = 25°C	10.5 V ≤ V_{IN} ≤ 23 V, 5 mA ≤ I_{OUT} ≤ 350 mA	7.6	—	8.4	V
Quiescent current		I_B	1	T_j = 25°C		—	4.6	8.0	mA
Quiescent current change	Line	ΔI_{BI}	1	T_j = 25°C	11 V ≤ V_{IN} ≤ 25.5 V, I_{OUT} = 200 mA	—	—	0.8	mA
	Load	ΔI_{BO}	1		5 mA ≤ I_{OUT} ≤ 350 mA	—	—	0.5	
Output noise voltage		V_{NO}	2	Tj = 25°C, 10 Hz ≤ f ≤ 100 kHz		—	60	250	μV_{rms}
Ripple rejection		R.R.	3	f = 120 Hz, I_{OUT} = 100 mA, 11.5 V ≤ V_{IN} ≤ 21.5 V, T_j = 25°C		55	62	—	dB
Short circuit current limit		I_{SC}	1	T_j = 25°C		—	960	—	mA
Dropout voltage		V_D	1	T_j = 25°C		—	1.7	—	V
Average temperature coefficient of output voltage		T_{CVO}	1	I_{OUT} = 5 mA		—	−1.0	—	mV/°C

TA78M09F
Electrical Characteristics
(Unless otherwise specified, V_{IN} = 15 V, I_{OUT} = 350 mA, 0°C ≤ T_j ≤ 125°C, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF)

Characteristics		Symbol	Test Circuit	Test Condition		Min	Typ.	Max	Unit
Output voltage		V_{OUT}	1	T_j = 25°C		8.64	9.0	9.36	V
Line regulation		Reg·line	1	T_j = 25°C	11.5 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 200 mA	—	5	100	mV
					13 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 200 mA	—	3	50	
Load regulation		Reg·load	1	T_j = 25°C	5 mA ≤ I_{OUT} ≤ 500 mA	—	26	180	mV
					5 mA ≤ I_{OUT} ≤ 200 mA	—	10	90	
Output voltage		V_{OUT}	1	T_j = 25°C	11.5 V ≤ V_{IN} ≤ 24 V, 5 mA ≤ I_{OUT} ≤ 350 mA	8.55	—	9.45	V
Quiescent current		I_B	1	T_j = 25°C		—	4.6	8.0	mA
Quiescent current change	Line	ΔI_{BI}	1	T_j = 25°C	12 V ≤ V_{IN} ≤ 26.5 V, I_{OUT} = 200 mA	—	—	0.8	mA
	Load	ΔI_{BO}	1		5 mA ≤ I_{OUT} ≤ 350 mA	—	—	0.5	
Output noise voltage		V_{NO}	2	Tj = 25°C, 10 Hz ≤ f ≤ 100 kHz		—	60	270	μV_{rms}
Ripple rejection		R.R.	3	f = 120 Hz, I_{OUT} = 100 mA, 12.5 V ≤ V_{IN} ≤ 22.5 V, T_j = 25°C		54	61	—	dB
Short circuit current limit		I_{SC}	1	T_j = 25°C		—	960	—	mA
Dropout voltage		V_D	1	T_j = 25°C		—	1.7	—	V
Average temperature coefficient of output voltage		T_{CVO}	1	I_{OUT} = 5 mA		—	−1.1	—	mV/°C

TA78M10F
Electrical Characteristics
(Unless otherwise specified, V_{IN} = 16 V, I_{OUT} = 350 mA, 0°C ≤ T_j ≤ 125°C, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF)

Characteristics		Symbol	Test Circuit	Test Condition		Min	Typ.	Max	Unit
Output voltage		V_{OUT}	1	T_j = 25°C		9.6	10.0	10.4	V
Line regulation		Reg·line	1	T_j = 25°C	12.5 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 200 mA	—	6	100	mV
					14 V ≤ V_{IN} ≤ 26 V, I_{OUT} = 200 mA	—	3	50	
Load regulation		Reg·load	1	T_j = 25°C	5 mA ≤ I_{OUT} ≤ 500 mA	—	26	200	mV
					5 mA ≤ I_{OUT} ≤ 200 mA	—	10	100	
Output voltage		V_{OUT}	1	T_j = 25°C	12.5 V ≤ V_{IN} ≤ 25 V, 5 mA ≤ I_{OUT} ≤ 350 mA	9.5	—	10.5	V
Quiescent current		I_B	1	T_j = 25°C		—	4.7	8.0	mA
Quiescent current change	Line	ΔI_{BI}	1	T_j = 25°C	13 V ≤ V_{IN} ≤ 26.5 V, I_{OUT} = 200 mA	—	—	0.8	mA
	Load	ΔI_{BO}	1		5 mA ≤ I_{OUT} ≤ 350 mA	—	—	0.5	
Output noise voltage		V_{NO}	2	Tj = 25°C, 10 Hz ≤ f ≤ 100 kHz		—	65	280	μV_{rms}
Ripple rejection		R.R.	3	f = 120 Hz, I_{OUT} = 100 mA, 13.5 V ≤ V_{IN} ≤ 23.5 V, T_j = 25°C		52	59	—	dB
Short circuit current limit		I_{SC}	1	T_j = 25°C		—	960	—	mA
Dropout voltage		V_D	1	T_j = 25°C		—	1.7	—	V
Average temperature coefficient of output voltage		T_{CVO}	1	I_{OUT} = 5 mA		—	−1.3	—	mV/°C

TA78M12F
Electrical Characteristics
(Unless otherwise specified, V_{IN} = 19 V, I_{OUT} = 350 mA, 0°C ≤ T_j ≤ 125°C, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF)

Characteristics		Symbol	Test Circuit	Test Condition		Min	Typ.	Max	Unit
Output voltage		V_{OUT}	1	T_j = 25°C		11.5	12.0	12.5	V
Line regulation		Reg·line	1	T_j = 25°C	14.5 V ≤ V_{IN} ≤ 30 V, I_{OUT} = 200 mA	—	7	100	mV
					16 V ≤ V_{IN} ≤ 30 V, I_{OUT} = 200 mA	—	3	50	
Load regulation		Reg·load	1	T_j = 25°C	5 mA ≤ I_{OUT} ≤ 500 mA	—	27	240	mV
					5 mA ≤ I_{OUT} ≤ 200 mA	—	10	120	
Output voltage		V_{OUT}	1	T_j = 25°C	14.5 V ≤ V_{IN} ≤ 27 V, 5 mA ≤ I_{OUT} ≤ 350 mA	11.4	—	12.6	V
Quiescent current		I_B	1	T_j = 25°C		—	4.8	8.0	mA
Quiescent current change	Line	ΔI_{BI}	1	T_j = 25°C	15 V ≤ V_{IN} ≤ 30.5 V, I_{OUT} = 200 mA	—	—	0.8	mA
	Load	ΔI_{BO}	1		5 mA ≤ I_{OUT} ≤ 350 mA	—	—	0.5	
Output noise voltage		V_{NO}	2	Tj = 25°C, 10 Hz ≤ f ≤ 100 kHz		—	70	300	μV_{rms}
Ripple rejection		R.R.	3	f = 120 Hz, I_{OUT} = 100 mA, 15 V ≤ V_{IN} ≤ 25 V, T_j = 25°C		50	57	—	dB
Short circuit current limit		I_{SC}	1	T_j = 25°C		—	960	—	mA
Dropout voltage		V_D	1	T_j = 25°C		—	1.7	—	V
Average temperature coefficient of output voltage		T_{CVO}	1	I_{OUT} = 5 mA		—	−1.6	—	mV/°C

TA78M15F
Electrical Characteristics
(Unless otherwise specified, V_{IN} = 23 V, I_{OUT} = 350 mA, 0°C ≤ T_j ≤ 125°C, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF)

Characteristics		Symbol	Test Circuit	Test Condition		Min	Typ.	Max	Unit
Output voltage		V_{OUT}	1	T_j = 25°C		14.4	15.0	15.6	V
Line regulation		Reg·line	1	T_j = 25°C	17.5 V ≤ V_{IN} ≤ 30 V, I_{OUT} = 200 mA	—	8	100	mV
					20 V ≤ V_{IN} ≤ 30 V, I_{OUT} = 200 mA	—	4	50	
Load regulation		Reg·load	1	T_j = 25°C	5 mA ≤ I_{OUT} ≤ 500 mA	—	27	300	mV
					5 mA ≤ I_{OUT} ≤ 200 mA	—	10	150	
Output voltage		V_{OUT}	1	T_j = 25°C	17.5 V ≤ V_{IN} ≤ 30 V, 5 mA ≤ I_{OUT} ≤ 350 mA	14.25	—	15.75	V
Quiescent current		I_B	1	T_j = 25°C		—	4.8	8.0	mA
Quiescent current change	Line	ΔI_{BI}	1	T_j = 25°C	18 V ≤ V_{IN} ≤ 30.5 V, I_{OUT} = 200 mA	—	—	0.8	mA
	Load	ΔI_{BO}	1		5 mA ≤ I_{OUT} ≤ 350 mA	—	—	0.5	
Output noise voltage		V_{NO}	2	Tj = 25°C, 10 Hz ≤ f ≤ 100 kHz		—	80	450	μV_{rms}
Ripple rejection		R.R.	3	f = 120 Hz, I_{OUT} = 100 mA, 18.5 V ≤ V_{IN} ≤ 28.5 V, T_j = 25°C		48	55	—	dB
Short circuit current limit		I_{SC}	1	T_j = 25°C		—	960	—	mA
Dropout voltage		V_D	1	T_j = 25°C		—	1.7	—	V
Average temperature coefficient of output voltage		T_{CVO}	1	I_{OUT} = 5 mA		—	−2.0	—	mV/°C

TA78M18F
Electrical Characteristics
(Unless otherwise specified, V_{IN} = 27 V, I_{OUT} = 350 mA, 0°C ≤ T_j ≤ 125°C, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF)

Characteristics		Symbol	Test Circuit	Test Condition		Min	Typ.	Max	Unit
Output voltage		V_{OUT}	1	T_j = 25°C		17.3	18.0	18.7	V
Line regulation		Reg·line	1	T_j = 25°C	21 V ≤ V_{IN} ≤ 33 V, I_{OUT} = 200 mA	—	9	100	mV
					24 V ≤ V_{IN} ≤ 33 V, I_{OUT} = 200 mA	—	5	50	
Load regulation		Reg·load	1	T_j = 25°C	5 mA ≤ I_{OUT} ≤ 500 mA	—	28	360	mV
					5 mA ≤ I_{OUT} ≤ 200 mA	—	10	180	
Output voltage		V_{OUT}	1	T_j = 25°C	21 V ≤ V_{IN} ≤ 33 V, 5 mA ≤ I_{OUT} ≤ 350 mA	17.1	—	18.9	V
Quiescent current		I_B	1	T_j = 25°C		—	4.8	8.0	mA
Quiescent current change	Line	ΔI_{BI}	1	T_j = 25°C	21.5 V ≤ V_{IN} ≤ 33.5 V, I_{OUT} = 200 mA	—	—	0.8	mA
	Load	ΔI_{BO}	1		5 mA ≤ I_{OUT} ≤ 350 mA	—	—	0.5	
Output noise voltage		V_{NO}	2	Tj = 25°C, 10 Hz ≤ f ≤ 100 kHz		—	90	490	μV_{rms}
Ripple rejection		R.R.	3	f = 120 Hz, I_{OUT} = 100 mA, 22 V ≤ V_{IN} ≤ 32 V, T_j = 25°C		46	53	—	dB
Short circuit current limit		I_{SC}	1	T_j = 25°C		—	960	—	mA
Dropout voltage		V_D	1	T_j = 25°C		—	1.7	—	V
Average temperature coefficient of output voltage		T_{CVO}	1	I_{OUT} = 5 mA		—	−2.5	—	mV/°C

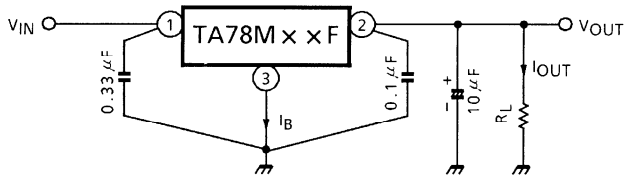
TA78M20F
Electrical Characteristics
(Unless otherwise specified, V_{IN} = 29 V, I_{OUT} = 350 mA, 0°C ≤ T_j ≤ 125°C, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF)

Characteristics		Symbol	Test Circuit	Test Condition		Min	Typ.	Max	Unit
Output voltage		V_{OUT}	1	T_j = 25°C		19.2	20.0	20.8	V
Line regulation		Reg·line	1	T_j = 25°C	23 V ≤ V_{IN} ≤ 35 V, I_{OUT} = 200 mA	—	10	100	mV
					24 V ≤ V_{IN} ≤ 35 V, I_{OUT} = 200 mA	—	6	50	
Load regulation		Reg·load	1	T_j = 25°C	5 mA ≤ I_{OUT} ≤ 500 mA	—	28	400	mV
					5 mA ≤ I_{OUT} ≤ 200 mA	—	10	200	
Output voltage		V_{OUT}	1	T_j = 25°C	23 V ≤ V_{IN} ≤ 35 V, 5 mA ≤ I_{OUT} ≤ 350 mA	19.0	—	21.0	V
Quiescent current		I_B	1	T_j = 25°C		—	4.9	8.0	mA
Quiescent current change	Line	ΔI_{BI}	1	T_j = 25°C	23.5 V ≤ V_{IN} ≤ 35.5 V, I_{OUT} = 200 mA	—	—	0.8	mA
	Load	ΔI_{BO}	1		5 mA ≤ I_{OUT} ≤ 350 mA	—	—	0.5	
Output noise voltage		V_{NO}	2	Tj = 25°C, 10 Hz ≤ f ≤ 100 kHz		—	95	540	μV_{rms}
Ripple rejection		R.R.	3	f = 120 Hz, I_{OUT} = 100 mA, 24 V ≤ V_{IN} ≤ 34 V, T_j = 25°C		46	53	—	dB
Short circuit current limit		I_{SC}	1	T_j = 25°C		—	960	—	mA
Dropout voltage		V_D	1	T_j = 25°C		—	1.7	—	V
Average temperature coefficient of output voltage		T_{CVO}	1	I_{OUT} = 5 mA		—	−3.0	—	mV/°C

TA78M24F
Electrical Characteristics
(Unless otherwise specified, V_{IN} = 33 V, I_{OUT} = 350 mA, 0°C ≤ T_j ≤ 125°C, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF)

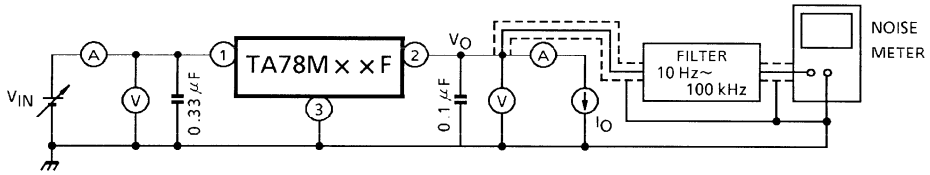
Characteristics		Symbol	Test Circuit	Test Condition		Min	Typ.	Max	Unit
Output voltage		V_{OUT}	1	T_j = 25°C		23.0	24.0	25.0	V
Line regulation		Reg·line	1	T_j = 25°C	27 V ≤ V_{IN} ≤ 38 V, I_{OUT} = 200 mA	—	12	100	mV
					28 V ≤ V_{IN} ≤ 38 V, I_{OUT} = 200 mA	—	7	50	
Load regulation		Reg·load	1	T_j = 25°C	5 mA ≤ I_{OUT} ≤ 500 mA	—	30	480	mV
					5 mA ≤ I_{OUT} ≤ 200 mA	—	10	240	
Output voltage		V_{OUT}	1	T_j = 25°C	27 V ≤ V_{IN} ≤ 38 V, 5 mA ≤ I_{OUT} ≤ 350 mA	22.8	—	25.2	V
Quiescent current		I_B	1	T_j = 25°C		—	5.0	8.0	mA
Quiescent current change	Line	ΔI_{BI}	1	T_j = 25°C	27.5 V ≤ V_{IN} ≤ 38.5 V, I_{OUT} = 200 mA	—	—	0.8	mA
	Load	ΔI_{BO}	1		5 mA ≤ I_{OUT} ≤ 350 mA	—	—	0.5	
Output noise voltage		V_{NO}	2	Tj = 25°C, 10 Hz ≤ f ≤ 100 kHz		—	115	650	μV_{rms}
Ripple rejection		R.R.	3	f = 120 Hz, I_{OUT} = 100 mA, 28 V ≤ V_{IN} ≤ 38 V, T_j = 25°C		46	53	—	dB
Short circuit current limit		I_{SC}	1	T_j = 25°C		—	960	—	mA
Dropout voltage		V_D	1	T_j = 25°C		—	1.7	—	V
Average temperature coefficient of output voltage		T_{CVO}	1	I_{OUT} = 5 mA		—	−3.5	—	mV/°C

Test Circuit 1 / Standard Application



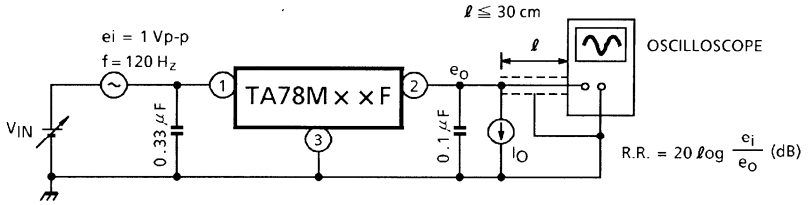
Test Circuit 2

V_{NO}

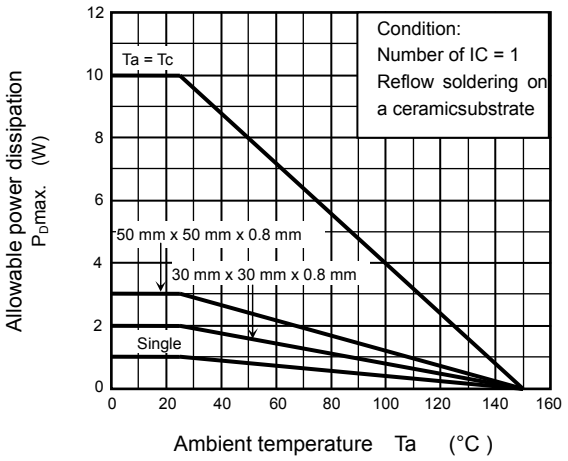


Test Circuit 3

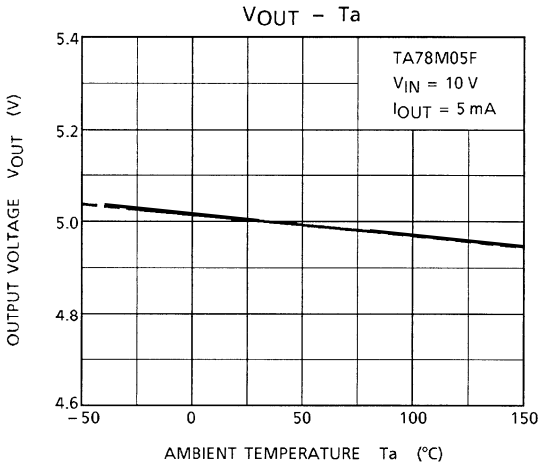
R.R.



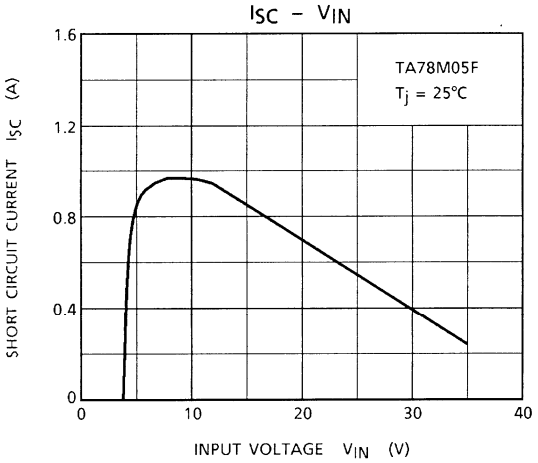
$P_D$max. – Ta



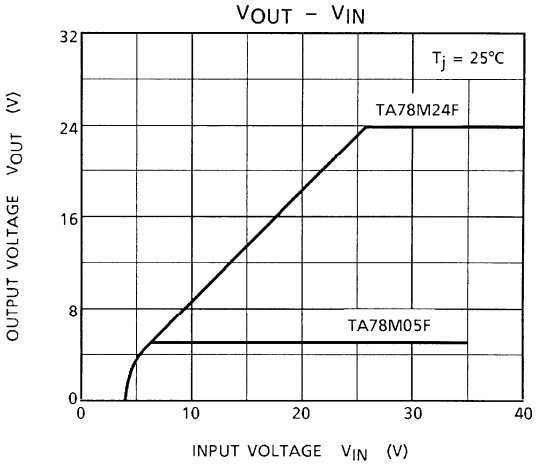
V_{OUT} – Ta



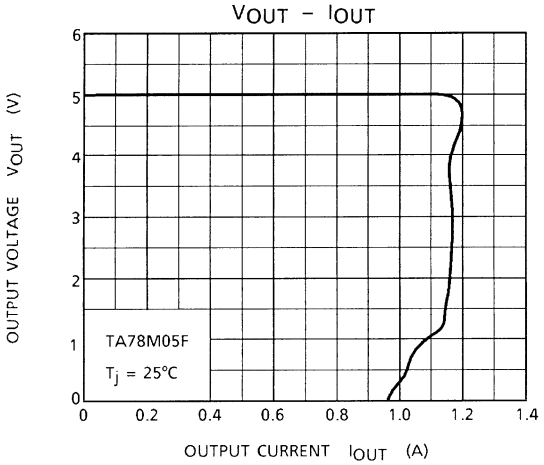
I_{SC} – V_{IN}



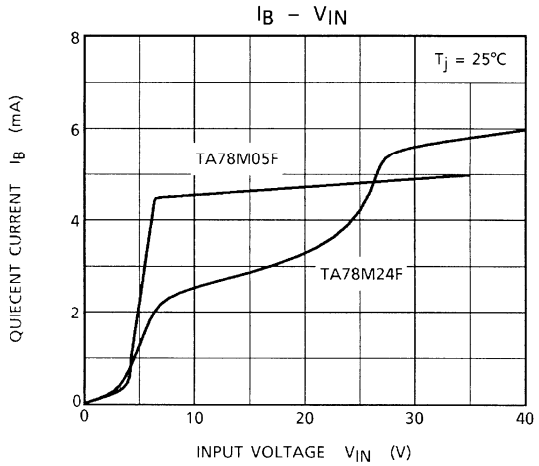
V_{OUT} – V_{IN}

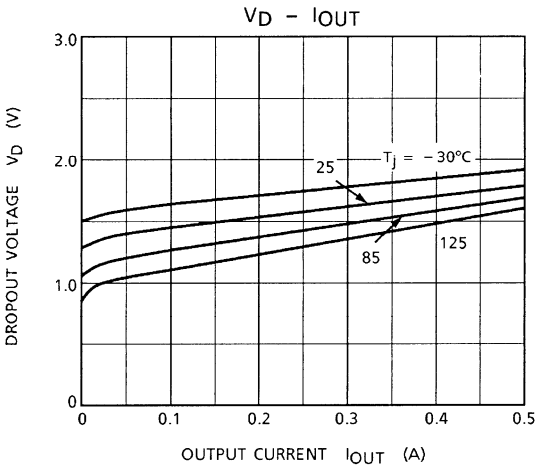


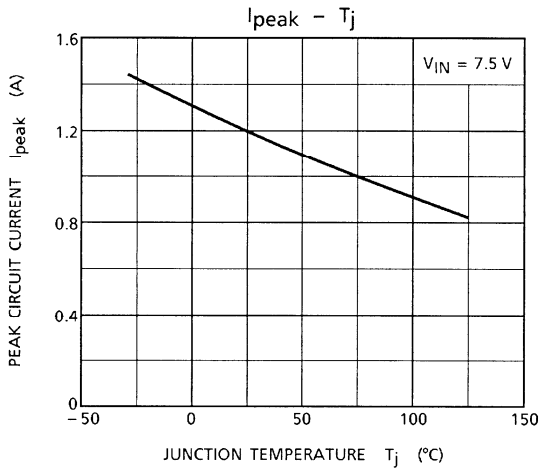
V_{OUT} – I_{OUT}

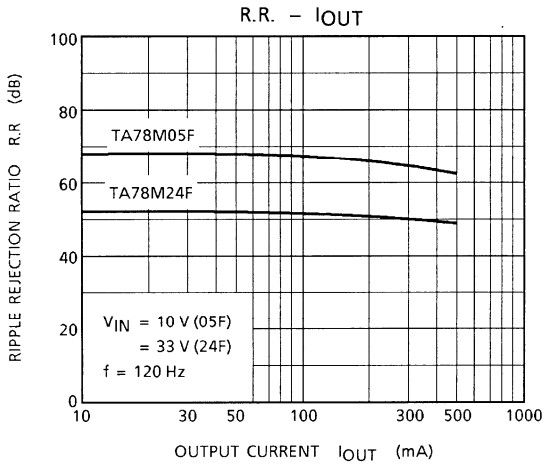


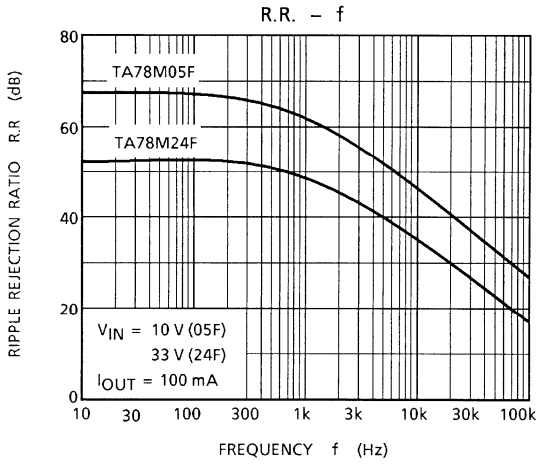
I_B – V_{IN}




V_D – I_{OUT}
DROPOUT VOLTAGE V_D (V)
OUTPUT CURRENT I_{OUT} (A)
T_j = −30°C
25
85
125
3.0
2.0
1.0
0
0.1
0.2
0.3
0.4
0.5


I_{peak} – T_j
PEAK CIRCUIT CURRENT I_{peak} (A)
JUNCTION TEMPERATURE T_j (°C)
V_{IN} = 7.5 V
1.6
1.2
0.8
0.4
0
−50
0
50
100
150

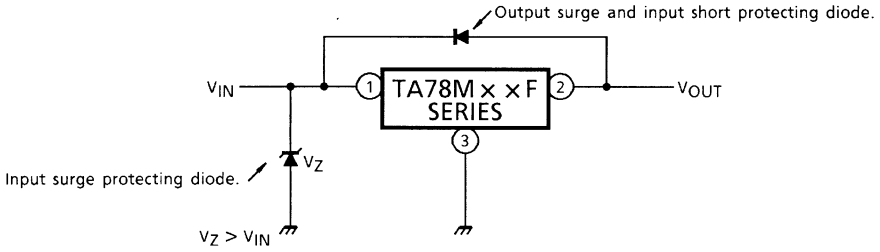

R.R. – I_{OUT}
RIPPLE REJECTION RATIO R.R (dB)
OUTPUT CURRENT I_{OUT} (mA)
TA78M05F
TA78M24F
V_{IN} = 10 V (05F)
= 33 V (24F)
f = 120 Hz
100
80
60
40
20
0
10
30
50
100
300
500
1000


R.R. – f
RIPPLE REJECTION RATIO R.R (dB)
FREQUENCY f (Hz)
TA78M05F
TA78M24F
V_{IN} = 10 V (05F)
33 V (24F)
I_{OUT} = 100 mA
80
60
40
20
0
10
30
100
300
1k
3k
10k
30k
100k

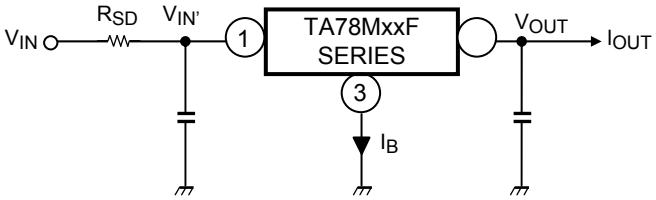
Usage Precautions

(1) In regard to GND, be careful not to apply a negative voltage to the input/output terminal.

(2) If a surge voltage exceeding the absolute maximum rating is applied to the input terminal or if a voltage in excess of the input terminal voltage is applied to the output terminal, the circuit may be destroyed.
Particular care is necessary in the case of the latter.
Circuit destruction may also occur if the input terminal shorts to GND in a state of normal operation, causing the output terminal voltage to exceed the input voltage (GND potential) and the electrical charge of the chemical capacitor connected to the output terminal to flow into the input side.
Where these risks exist, take steps such as connecting Zener and general silicon diodes to the circuit, as shown in the figure below.



(3) When the input voltage is too high, the power dissipation of the three-terminal regulator, which is a series regulator, increases, causing the junction temperature to rise. In such a case, it is recommended to reduce the power dissipation, and hence the junction temperature, by inserting a power-limiting resistor R_{SD} in the input terminal.



The power dissipation P_D of the IC is expressed in the following equation.

$$P_D = (V_{IN'} - V_{OUT}) \cdot I_{OUT} + V_{IN'} \cdot I_B$$

Reducing $V_{IN'}$ below the lowest voltage necessary for the IC will cause ripple, deterioration in output regulation and, in certain circumstances, parasitic oscillation.
To determine the resistance value of R_{SD}, design with a margin, referring to the following equation.

$$R_{SD} < \frac{V_{IN} - V_{IN'}}{I_{OUT} + I_B}$$

(4) Be sure to connect a capacitor near the input terminal and output terminal between both terminals and GND. The capacitances should be determined experimentally because they depend on printed circuit board patterns. In particular, adequate investigation should be made to ensure there is no problem even in high or low temperatures.

(5) The molded plastic portion of this unit, measuring 5.5 mm (L) by 6.5 mm (W) by 2.3 mm (T), is more compact compared to its equivalent TO-220.
The collector fin extends directly out of the main body and can be soldered directly to the ceramic circuit board for significant increase in collector power dissipation.
To obtain high reliability on the heat sink design of a regulator IC, it is generally required to derate more than 20% of maximum junction temperature (T_j max).
Further, full consideration should be given to the installation of the IC on a heat sink.

- Low voltage

  Do not apply voltage to the Product that is lower than the minimum operating voltage, or the Product's protective functions will not operate properly and the Product may be permanently damaged.

- Overcurrent Protection

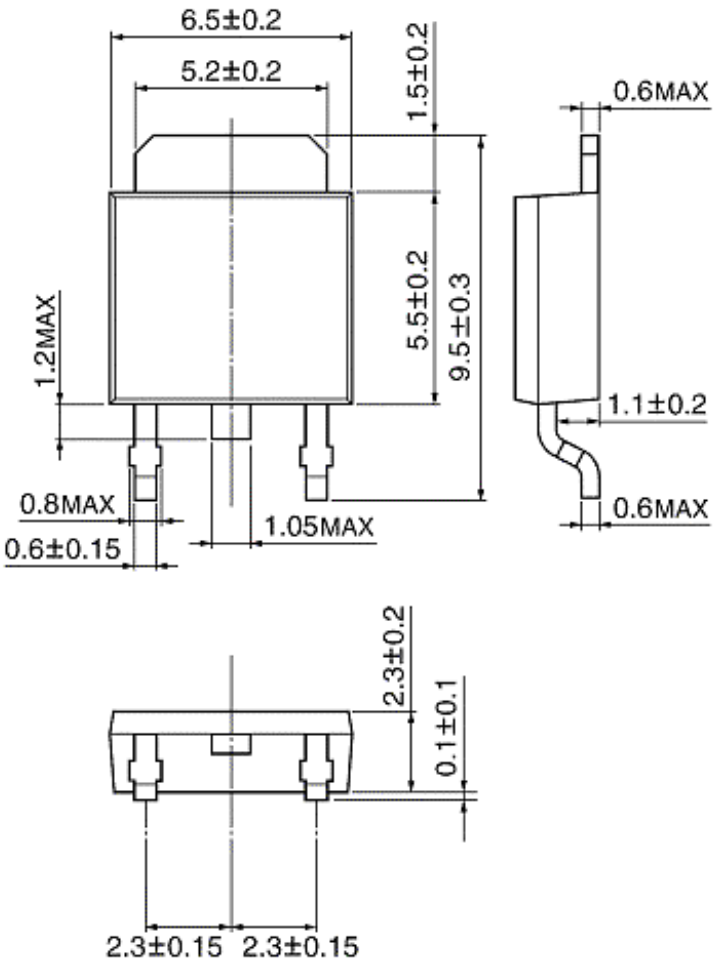
  The overcurrent protection circuits in the Product are designed to temporarily protect Product from minor overcurrent of brief duration. When the overcurrent protective function in the Product activates, immediately cease application of overcurrent to Product. Improper usage of Product, such as application of current to Product exceeding the absolute maximum ratings, could cause the overcurrent protection circuit not to operate properly and/or damage Product permanently even before the protection circuit starts to operate.

- Overheating Protection

  The thermal shutdown circuits in the Product are designed to temporarily protect Product from minor overheating of brief duration. When the overheating protective function in the Product activates, immediately correct the overheating situation. Improper usage of Product, such as the application of heat to Product exceeding the absolute maximum ratings, could cause the overheating protection circuit not to operate properly and/or damage Product permanently even before the protection circuit starts to operate.

Package Dimensions

HSOP3-P-2.30D Unit: mm



Weight: 0.36 g (typ.)

RESTRICTIONS ON PRODUCT USE

- Toshiba Corporation, and its subsidiaries and affiliates (collectively “TOSHIBA”), reserve the right to make changes to the information in this document, and related hardware, software and systems (collectively “Product”) without notice.
- This document and any information herein may not be reproduced without prior written permission from TOSHIBA. Even with TOSHIBA’s written permission, reproduction is permissible only if reproduction is without alteration/omission.
- Though TOSHIBA works continually to improve Product’s quality and reliability, Product can malfunction or fail. Customers are responsible for complying with safety standards and for providing adequate designs and safeguards for their hardware, software and systems which minimize risk and avoid situations in which a malfunction or failure of Product could cause loss of human life, bodily injury or damage to property, including data loss or corruption. Before creating and producing designs and using, customers must also refer to and comply with (a) the latest versions of all relevant TOSHIBA information, including without limitation, this document, the specifications, the data sheets and application notes for Product and the precautions and conditions set forth in the “TOSHIBA Semiconductor Reliability Handbook” and (b) the instructions for the application that Product will be used with or for. Customers are solely responsible for all aspects of their own product design or applications, including but not limited to (a) determining the appropriateness of the use of this Product in such design or applications; (b) evaluating and determining the applicability of any information contained in this document, or in charts, diagrams, programs, algorithms, sample application circuits, or any other referenced documents; and (c) validating all operating parameters for such designs and applications. **TOSHIBA ASSUMES NO LIABILITY FOR CUSTOMERS’ PRODUCT DESIGN OR APPLICATIONS.**
- Product is intended for use in general electronics applications (e.g., computers, personal equipment, office equipment, measuring equipment, industrial robots and home electronics appliances) or for specific applications as expressly stated in this document. Product is neither intended nor warranted for use in equipment or systems that require extraordinarily high levels of quality and/or reliability and/or a malfunction or failure of which may cause loss of human life, bodily injury, serious property damage or serious public impact (“Unintended Use”). Unintended Use includes, without limitation, equipment used in nuclear facilities, equipment used in the aerospace industry, medical equipment, equipment used for automobiles, trains, ships and other transportation, traffic signaling equipment, equipment used to control combustions or explosions, safety devices, elevators and escalators, devices related to electric power, and equipment used in finance-related fields. Do not use Product for Unintended Use unless specifically permitted in this document.
- Do not disassemble, analyze, reverse-engineer, alter, modify, translate or copy Product, whether in whole or in part.
- Product shall not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable laws or regulations.
- The information contained herein is presented only as guidance for Product use. No responsibility is assumed by TOSHIBA for any infringement of patents or any other intellectual property rights of third parties that may result from the use of Product. No license to any intellectual property right is granted by this document, whether express or implied, by estoppel or otherwise.
- **ABSENT A WRITTEN SIGNED AGREEMENT, EXCEPT AS PROVIDED IN THE RELEVANT TERMS AND CONDITIONS OF SALE FOR PRODUCT, AND TO THE MAXIMUM EXTENT ALLOWABLE BY LAW, TOSHIBA (1) ASSUMES NO LIABILITY WHATSOEVER, INCLUDING WITHOUT LIMITATION, INDIRECT, CONSEQUENTIAL, SPECIAL, OR INCIDENTAL DAMAGES OR LOSS, INCLUDING WITHOUT LIMITATION, LOSS OF PROFITS, LOSS OF OPPORTUNITIES, BUSINESS INTERRUPTION AND LOSS OF DATA, AND (2) DISCLAIMS ANY AND ALL EXPRESS OR IMPLIED WARRANTIES AND CONDITIONS RELATED TO SALE, USE OF PRODUCT, OR INFORMATION, INCLUDING WARRANTIES OR CONDITIONS OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, ACCURACY OF INFORMATION, OR NONINFRINGEMENT.**
- Do not use or otherwise make available Product or related software or technology for any military purposes, including without limitation, for the design, development, use, stockpiling or manufacturing of nuclear, chemical, or biological weapons or missile technology products (mass destruction weapons). Product and related software and technology may be controlled under the Japanese Foreign Exchange and Foreign Trade Law and the U.S. Export Administration Regulations. Export and re-export of Product or related software or technology are strictly prohibited except in compliance with all applicable export laws and regulations.
- Please contact your TOSHIBA sales representative for details as to environmental matters such as the RoHS compatibility of Product. Please use Product in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. TOSHIBA assumes no liability for damages or losses occurring as a result of noncompliance with applicable laws and regulations.